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ABSTRACT

The psychometric properties of a paper-and-pencil instrument for assessing individual differences in cerebral dominance are explored. The instrument, Your Style of Learning and Thinking (SOLAT), contains 50 multiple-choice questions. The study subjects consisted of three groups: 235 undergraduate and graduate students, 124 undergraduate and graduate students, and 74 adults who had sustained brain injury after the age of 13 years. The latter group, who were enrolled at a community college, possessed normal fluid intelligence. The study was conducted in three phases: the first phase examined the SOLAT's construct validity; the second phase assessed the SOLAT's internal consistency and test/retest reliability coefficients; and the third phase further studied the SOLAT's construct validity by comparing the performance of brain injured and normal adults. Contrary to the predictions of cerebral dominance theory, a principal factor analysis for construct validity revealed a seven-factor solution. Assessment of the instrument's internal consistency and test-retest reliability indicated low to moderate correlations for these aspects. The further assessment of construct validity indicated that, with one exception, the instrument found no significant differences between the performances of brain-injured and normal adults. These results do not support the notion of hemisphericity, at least as measured by the instrument involved. This instrument should not be used by educators to differentiate students in terms of preferred mode of processing. Moreover, it is concluded that instructional planning that focuses on hemisphericity only detracts from more important sources of individual differences (such as attention and concentration, coding, and use of cognitive strategies). A 36-item list of references and six data tables are included. (TJH)

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Measuring Cerebral Dominance: Implications for Education

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Abstract

Instructional methods in the classroom today are often based on the notion of hemisphericity. The link however between hemispheric laterality research and educational practice appears to be highly questionable. One instrument teachers employ to assess individual differences in cerebral dominance is a paper-and-pencil survey called Your Style of Thinking and Learning (SOLAT). The present study explored the psychometric properties of this test in three phases. The first phase examined the instrument's construct validity. Contrary to cerebral dominance theory, a principal factor analysis revealed a seven factor solution. The second phase was conducted to determine the SOLAT's internal consistency and test-retest reliability coefficients. As expected, low to moderate correlations were generated from these analyses. In the final phase, SOLAT's construct validity was further studied by comparing the performances of brain-injured and normal adults. With one exception, no significant differences were found. The results of this investigation do not support the notion of hemisphericity, at least as measured by the SOLAT. This instrument should not be used by educators to differentiate students in terms of preferred mode of processing. Moreover, instructional planning which focuses on hemisphericity only detracts from more important sources of individual differences,

such as, attention and concentration, coding, deployment of cognitive strategies and other more fundamental information processing components.

Measuring Cerebral Dominance: Implications for Education

For almost two decades now a number of educators have propagated the concept of hemispheric laterality or hemisphericity as a fundamental learning style. The topic has repeatedly surfaced in a variety of periodicals, conferences, workshops, self-help books, and is even discussed within introductory educational psychology texts (e.g., Dembo, 1988). Much of the notoriety stems from such "high profile" educators as Madeline Hunter (1976) and E. P. Torrance (1981, 1982). These authors publicly advocate that schools should modify existing instructional methods and assessment procedures based upon the assumption of hemispheric specialities (Hardyck & Haapanen, 1979; O'Boyle, 1986; Springer, 1989).

In the attempt to dichotomize cerebral processing, Torrance (1981) states that whereas left-hemisphere functioning involves activities like sitting erect and thinking, betting on a sure thing, writing nonfiction and learning algebra, right-hemisphere functioning includes such things as lying down and thinking, playing hunches, writing fiction, and learning geometry. According to Taggart and Torrance (1984), verbal and logical thought processes can be further traced to the left cerebral hemisphere, while spatial and intuitive thinking are

located in the right hemisphere. Apparently, human beings possess distinctive information processing tactics. Left-hemisphere tactics, for example, can be characterized as "structured, verbal, facts, sequences, outline, and logical" and right-hemisphere strategies are "open-ended, spatial, ideas, relationships, summary, and intuitive" (Taggart & Torrance, 1984, p. 2). More recently, Torrance and Rockenstein (1988) have dissected creativity into behaviors associated with left and right hemisphere thinking.

As such, certain instructional methods, curricula, and assessment instruments currently used in schools are based on the notion of hemisphericity (Druckman & Swets, 1988; O'Boyle, 1986). Hunter (1976), for instance, states that school curriculum is primarily aimed at "left-brained" learners, ignoring those students with more "right-brained" learning styles. Other authors support this perspective, arguing that the educational agenda of most schools revolves around such "left-brained" subjects as reading, writing and mathematics (e.g., Cooke & Haipt, 1986; Kane & Kane, 1979; Hopkins, 1984). Advocates for whole-brain curricula are concerned that teachers are unwittingly discouraging creativity by the disproportionate amount of left-brain instruction (e.g.,

Bogen, 1977; Samples, 1975; Torrance and Rockenstein, 1988; Torrance, 1981). Similarly, Lord (1984) claims that students who are high achievers in science tend to be more right-brained in their method of information processing. He implies that science instructors should teach problem solving as a right-brained activity. With these issues in mind, McCarthy, Hammond and Samples (1985) have developed a science methods text integrating concepts from Piagetian theory, as well as from learning styles and hemispheric laterality research (see also McCarthy, 1980). Not only have Cooke and Haipt (1986) proposed in a National Education Association publication an integrative or whole-brain teaching/learning model, certain math educators have suggested that the implications of brain asymmetry literature be included in their discipline as well (e.g., Creswell and Gifford, 1988). Other "whole-brain" training programs are extensively reviewed in Druckman and Swets (1988). Finally, other educators contend that differences between the two hemispheres and the importance of dominance (or lack thereof) can be utilized to determine certain childhood problems (see review in Gardner, 1978, 1986).

The contemporary view of brain asymmetry is derived from three basic lines of research (for extensive reviews

see O'Boyle, 1986; Hellige, 1990; O'Boyle & Hellige, 1989; Springer, 1989; Springer & Deutsch, 1989). Initially, neurological investigations by Broca, Dax, Wernicke and others, in the early to mid-1800s with unilateral brain-injured patients, provided some evidence of a functional specialization of the hemispheres (O'Boyle, 1986). Broca (1863, as cited in Springer & Deutsch, 1989) discovered the significant relationship between the brain's left hemisphere and the function of speech. His notion of asymmetry contributed to the theory of cerebral dominance, where speech, language and other cognitive processes were considered left-hemisphere specializations. Shortly thereafter, J. H. Jackson (1864, as cited in Springer & Deutsch, 1989) intimated that the brain's right side may also have some distinct functions. His contention was largely ignored until the 1930s, when clinical data providing evidence for the right-hemisphere's role in spatial and music abilities received widespread support (Springer, 1989). Subsequently, the direction of brain research shifted to the idea of complementary specialization, where no one hemisphere dominates the other. Instead, the two halves complement each other, while still possessing different specialized functions.

A second source of evidence was derived from the

"split-brain" studies of Roger Sperry and his graduate students (most notably Michael Gazzaniga) at the California Institute of Technology. During the 1960's, working with a group of severely epileptic patients, Sperry was able to confirm Broca's original findings. By severing the corpus callosum in these patients, and thereby, disrupting the neural pathways which allow for normal communication between both hemispheres, investigators have delineated, in part, various lateralized cognitive processing abilities (Hellige, 1990; O'Boyle, 1986). O'Boyle (1986), however, has criticized these studies, arguing that they have serious problems of methodology and subsequent interpretation.

The third line of evidence has emerged from the assessment of normal individuals without brain injuries. In summarizing this work, Springer (1989) indicated that investigators attempted to link the experimental findings with underlying hemispheric differences in information processing abilities, where the left side is associated with serial and analytical processing and the right hemisphere with holistic and parallel processing. The studies examined the auditory, tactile and visual modalities, as well as the monitoring of certain anatomical reactions when subjects performed tasks

designed to differentially engage either the right or left hemisphere. Even though only subtle differences were observed among visual and verbal tasks, the literature seems to provide additional support for the existence of left-brain, right-brain processing asymmetries (Corballis, 1989; O'Boyle, 1986; Springer, 1989; Springer & Deutsch, 1989).

Although there is a considerable amount of experimental support for the concept of hemispheric asymmetry, especially in the domains of language and spatial abilities, the proposed relationship between these findings and educational practice discussed above seems to be overly simplistic, and perhaps even spurious (e.g., Calvin, 1983; O'Boyle, 1986; Springer, 1989). While Gardner (1986) argues that the issue has produced a number of "excessive claims" about the processing differences between the two hemispheres, Hellige (1990) believes that "there is no scientific foundation for the idea [hemisphericity]" (p. 76) at all. According to Levy (1985), cognitive processing takes place very rapidly and therefore cannot be localized on one particular side of the brain. Similarly, Das (1989a), drawing on the seminal work of A. R. Luria (e.g., 1973), theorizes that cognition can be understood as the interdependent functioning of

three neuropsychological subsystems: arousal and attention, coding, and planning. Das, Kirby, and Jarman (1979) have examined the coding function in its two forms, that is, simultaneous and successive processing, where neither cognitive function is localized in one hemisphere or the other (see also Das 1984a, 1984b, 1989a). Thus, any cognitive task requires both types of processing (Das, 1989a). Springer and Deutsch (1989) apparently concur with Das's position by stating: "Almost any human behavior or higher mental function, however, clearly involves more than the actual specialities of either hemisphere and utilizes what is common to both hemispheres" (p. 71). In contrast, the idea of cerebral dominance implies that simultaneous processing is a right-brained function, whereas successive processing is typically associated with left-brain activity. In light of this apparent conflict, it would appear that the use of hemispheric laterality research to guide and direct educational practice is highly questionable (e.g., Das, 1989b; O'Boyle, 1986). Springer and Deutsch (1989) challenge those advocates of left-brain right-brain dominance theory to submit empirical evidence which supports their ideas (see also Springer, 1989).

As Hellige (1990) points out, recent popularized

accounts have claimed that hemisphericity can be easily assessed and employed to classify individuals as either "right-brained," "left-brained," or "whole-brained." One such instrument educators currently use to measure cerebral dominance is the Human Information Processing Survey (HIP Survey) (Taggart & Torrance, 1984). The HIP Survey was originally designated as Form C, Your Style of Learning and Thinking or SOLAT (Torrance, Reynolds, Riegel, & Ball, 1977). Both versions were developed to sample the specialized cerebral functions of the right and left hemispheres (Taggart & Torrance, 1984, p. 28). The test manual for the HIP Survey presents very limited reliability and validity data; however, Taggart and Torrance (1984) review a number of "empirical" studies which evaluate SOLAT's psychometric properties. Regrettably, most of the literature reviewed exists in the form of unpublished manuscripts unavailable to further scientific analysis. In addition, the papers discussed in Taggart and Torrance (1984) possess severe methodological shortcomings. The majority of the studies, for instance, reported limited sample sizes, while concurrent validity and construct validity were examined using instruments with inadequate psychometric properties (e.g., Torrance Test of Creative Thinking, Creative Motivation Scale, What

Kind of Person are You?, Rorschach Inkblot, etc.). When reliability issues were addressed, only the SOLAT's test-retest coefficients were of significant magnitudes. These reliability estimates were inconsistent, however, ranging from .55 to .86.

Recently, Das (1989b) reviewed the HIP and its predecessor the SOLAT. Utilizing the research by Fitzgerald and Hattie (1983), he finds these instruments completely lacking in empirical support. Moreover, the theoretical foundation for these tests is extremely weak. In sum, Das (1989b) unequivocally regards the HIP (and the SOLAT) "to have such an unjustified theoretical base that its validity as a measure of thinking style of left-brained and right-brained people is questionable, hence its [HIP] unreliability will be of only academic interest to the users" (pp. 363-364).

Given the methodological problems of earlier validation studies and the dubious nature of the "hemisphericity" construct, the SOLAT requires a statistical reassessment. Thus, the intent of this investigation is to evaluate the instrument's underlying psychometric properties and discuss their implications for educational practice.

Method

Subjects and Procedure

The current investigation was conducted in the following three phases:

Phase One: In order to determine construct validity, SOLAT was administered to a large group of undergraduate and graduate students (N = 235) at a small mid-western university. This comprehensive university is located in a large metropolitan area and serves a multi-ethnic student population (Mdn age = 35).

According to the theory of cerebral dominance, the SOLAT instrument purports to identify individuals on a continuum as either being left-brained, right-brained, or whole-brained (integrated processing). If the SOLAT possesses construct validity, it is therefore hypothesized that a factor analysis of the instrument should approximate a three-factor solution corresponding to the three modes of information processing.

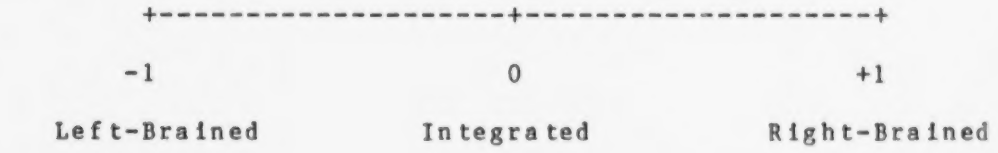
Phase Two: To determine the internal consistency and test-retest reliability coefficients, SOLAT was administered to a second sample (N = 124) at the same university. Six classes of undergraduate and graduate students completed the survey approximately six weeks apart.

Phase Three: As a further examination of construct validity, the SOLAT was administered to both normal and brain-injured (BI) adults. The participants for this sample were 74 adults who sustained a brain injury after the age of 13, were enrolled in a Southern California community college and possessed normal fluid intelligence. The median age for this group was 28 years. The mental ability of the BI group was derived from the total score on the Raven Standard Progressive Matrices (Raven, 1958), where the average number of correct responses was 46.04, *SD* = 8.62. Due to the nature of their brain injuries, the SOLAT was individually administered by a trained assistant. A comparison group of normal subjects (*N* = 74) was randomly selected from the larger group of university students discussed in Phase One above.

Instrument

The SOLAT instrument employed in this investigation is presented in Torrance et al. (1977). Corresponding to the scoring procedure discussed on the survey's answer sheet, each of the 50 questions had three possible responses (A, B, or C), which were then coded by the researchers as either +1 for right-brain preference, 0 for whole-brain preference, or -1 for left-brain preference. Item 3, for example, requires the subjects to indicate

their preference between multiple choice tests (A) or essay tests (B) or both kinds of tests (C). According to cerebral dominance theory, individuals who prefer multiple-choice tests have "left-brained" learning styles and their responses were coded -1. Similarly, preference towards essay tests are presumed to reflect a "right-brained" learning style and were coded +1. Those subjects which indicated a preference for both kinds of examinations are assumed to have an "integrated" learning style and their response was coded 0. Thus, subjects' responses to each of 50 items were placed on the following theoretical continuum:



Results

Phase One: Dimensionality of the SOLAT instrument was determined by a principal factor analysis with the maximum likelihood procedure employed for the communality estimates and promax oblique rotations. The number of factors extracted was based on the preliminary eigenvalues, scree plot, and the percent of variance each factor contributed to the total variance. In marking specific factors, the minimum correlation of an item with

a factor was set at .30. Correlations of this magnitude or higher were thus retained for subsequent analyses.

Of the 50 items assessing cerebral dominance, 41 were found useful in defining the dimensions of the scale. Items which were eliminated from further analysis because low correlations with the seven factors include the following items: 1, 8, 28, 31, 41, 43, 44, and 49. These items assessed such things as memory for names and faces, ability "to find" directions, preference for either algebra or geometry, preferences for either dogs or cats, and so forth.

Table 1 reveals the factor structure for the 41 items employed in the analysis. A total of seven factors were extracted, accounting for 100 percent of the total variance. The first factor, contributing 39 percent of the variance, was comprised of seven items, involving primarily a preference for words or images in learning and explanations. Factor 1 was labeled "Verbal vs. Visual." The second factor, contributing 17 percent of the variance, was defined by eight items involving approaches to solving problems. Factor 2 was defined as "Style of Problem Solving." The third factor, explaining 13 percent of the variance, was defined by seven items involving various aspects of planning and organization. Factor 3

was termed "Planning and Organization." The fourth factor, accounting for 10 percent of the variance, was marked by five items assessing insight from poetry, symbols, or inventiveness. Factor 4 was labeled "Creativity." The fifth factor, explaining seven percent of the variance, was defined by five items generally involving humor and playfulness and was defined as "Humor." The sixth factor, contributing seven percent of the total variance as well, was marked by five items involving the intellect versus emotions. Factor 6 was termed "Logical vs. Intuitive." The seventh and final factor contributed 6 percent of the variance and was defined by 4 items relating to a preference for reading either fiction or non-fiction books. Factor 7 was labeled "Reading Preference."

Insert Table 1 about here

The factor intercorrelations are given in Table 2. It is interesting to note that nearly all correlations between the factors are negatively correlated and relatively small in magnitude. The strongest correlation, which is negative, appears between Factor 1 (Verbal vs. Visual) and Factor 3 (Planning and Organization), $\underline{r}$ =

-0.26. Overall, the seven dimensions of SOLAT seem to be independent and unrelated.

Insert Table 2 about here

Phase Two: The internal consistency (Cronbach's Alpha) and test-retest reliability coefficients for each factor are shown in Table 3. Inspection of the data reveals low to moderate reliability coefficients for the seven dimensions during Time 1. The highest reliability estimate ($\underline{r}$ = .61) for Factor 1, accounts for only 36 percent of the total variability. The internal consistency reliability coefficients presented for Factor 5 (Humor) and Factor 7 (Reading Preference) are clearly unacceptable ($\underline{r}$ = .35 and $\underline{r}$ = .34, respectively). The internal consistency reliabilities computed for Time 2 across each dimension were equally low, ranging from .26 for Factor 5 to .59 for Factor 1. The test-retest reliability coefficients computed from Time 1 to Time 2 were, at best, marginally acceptable, ranging from .65 to .77 in magnitude.

Insert Table 3 about here

Phase 3: A one-way ANOVA was computed between the normal sample (N = 74) and the brain-injured group (N = 74) on each dimension of the SOLAT. No significant differences were found between the two groups on six of the seven factors. The exception was for Factor 3, Planning and Organization. The normal subjects indicated somewhat more of a "right-brained" processing style (M = 0.30, SD = 2.56), whereas the responses of the brain-injured subjects (M = -0.89, SD = 2.59) reflect a "left-brained" tendency in cognitive processing ($F(1, 146)$ = 7.87, $p < .01$). Means and standard deviations for each group on the seven factors are presented in Table 4. It is interesting to note the large variability on each factor within each group.

Insert Table 4 about here

In order to investigate potential differences in learning style or processing differences, an ANOVA was computed using only the brain-injured subjects. The independent variable was the localization of the cerebral damage: left hemisphere, right hemisphere, or diffuse (i.e., bilateral damage). The dependent measure was the factor score on each of the seven dimensions. From the

theory of cerebral dominance, it was hypothesized that subjects would not prefer learning styles corresponding to their brain injury. For example, a person with a right hemisphere lesion would not prefer activities or tasks presumed to demand right-brained processing. The results of the seven ANOVA's revealed no significant differences on the total score on each dimension for the right-brain, left-brain, or bilateral brain-injured students. Means and standard deviations for each group are shown in Table 5.

Insert Table 5 about here

A correlational analysis between the total score on each factor and the localization of the brain-injury is presented in Table 6. No significant relationships were found between the location of the brain injury and the subjects' responses on each of the seven factors.

Insert Table 6 about here

Discussion

Although its psychometric properties have gone largely unsubstantiated, for the past ten or so years,

various educators have attempted to measure cerebral dominance or hemisphericity using a paper-and-pencil survey called the SOLAT. Many teachers continue to be advised by well known educational researchers that classroom instruction should be modified in accordance with their students' preferred mode of information processing. Thus, in theory, students with a left-brain preference or a right-brain preference should to be taught with these differences in mind. Curriculum and materials should correspond to these processing differences as well. Other educators suggest that instruction should be directed at "whole-brain" thinking which emphasizes an integrative learning-teaching model.

While these suggestions appear on the surface to have some intuitive appeal, based upon the findings of this study, the instrument employed to measure left-brain and right-brain processing differences does not possess sufficient reliability and construct validity to warrant further consideration by teachers. Contrary to cerebral dominance theory as discussed by Taggart and Torrance (1984), the SOLAT's factor structure seems to approximate seven dimensions rather than three underlying and distinct modes of processing (i.e., left-brain, right-brain, or whole-brain thinking). When brain-injured adults were

given the survey, it was expected that subjects with right or left hemisphere damage would not prefer a corresponding mode of information processing. The results indicate, however, that localization of brain injury has little or no relationship to total score on each of the test's seven dimensions. It was further hypothesized that the item responses (i.e., total score) across each factor would differ significantly between the two groups. In fact, normal and brain-injured adults largely answered the questions in a similar manner. As such, the SOLAT appears to measure preferences at a surface level, rather than more fundamental (i.e, neurological) differences in processing abilities.

Since this instrument has limited construct validity, the issue of its reliability becomes inconsequential. However, when the internal consistency and test-retest reliabilities of the SOLAT were examined, these estimates were generally low to moderate in strength. Only the test-retest reliabilities seemed to correspond to those presented in Taggart and Torrance (1990, p. 28).

Moreover, the above results lend further support for the conclusions discussed in two previous reviews of the SOLAT (Das, 1989b; Fitzgerald & Hattie, 1983). Both publications confirm that this survey is theoretically

unsound, lacks a coherent scoring procedure, has faulty items with low reliabilities, and appears to have little, if any, concurrent validity. As such, Das's (1989b) analysis of the scale merits repeating here: "What can a reviewer say in regard to a test for which there is no empirical or theoretical basis, especially when the test seeks to attribute multidimensional human behavior as managerial thinking to brain lateralization?" (p. 144).

The fundamental problem with this instrument clearly lies in the misguided attempt to link highly sophisticated neuroanatomical functioning in the right and left cerebral hemispheres with three discreet modes of information processing. As various researchers in the fields of neurology and neuropsychology point out, the notion of hemisphericity is founded primarily on inconclusive evidence (e.g., Calvin, 1983; Das, 1989b; Druckman & Swets, 1988; Gazzaniga, 1985; Hellige, 1990; O'Boyle, 1986; O'Boyle & Hellige, 1989; Springer, 1989; Springer & Deutsch, 1989). As such, brain lateralization research has limited application to education. Exaggerated claims by educators that differences in learning style reflect more fundamental hemispheric differences must be dispelled.

While teachers need not alter or supplement existing

curriculum or teaching methods based upon a student's score on the SOLAT, they should, however, be sensitive to individual differences in cognitive abilities. Understanding how children attend to the task, code various types of information and deploy cognitive strategies can assist teachers in the educational process (Das, 1984a, 1984b; Das et al., 1979). Additionally, rather than using a single teaching method, multiple methods of instruction will, in part, enhance student learning (O'Boyle, 1986). Finally, educational programs which supposedly train students to compensate for hemisphericity through teaching integrative processing techniques have little empirical support (e.g., Druckman & Swets, 1988; Hellige, 1990). Teachers would do well to avoid such "quick-fix" programs.

In summary, the notion of cerebral dominance (or hemisphericity) is of limited theoretical or practical value to educators. Any attempt to measure this construct using the SOLAT will lead to highly questionable results. Schools should not "rely on hemispheric laterality as a panacea for all our educational woes..." (O'Boyle, 1986, p. 43). Teachers should, therefore, use extreme caution when applying neuropsychological research to the classroom.

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Table 1

Rotated Factor Structure (Correlations), Communality Estimates, and Eigenvalues for Your Style of Thinking and Learning Scale (SOLAT)

Factor 1: (7 items) Verbal vs. Visual	1	2	3	4	5	6	7	h2
Item 7	.45	.20	.18	.02	.32	.02	.17	.27
Item 23	.57	.10	.22	-.06	.17	.18	-.02	.36
Item 24	.63	.09	.13	-.01	.44	.05	-.05	.50
Item 25	.54	.05	.17	.12	.11	.22	.04	.32
Item 27	.48	.19	.11	.14	-.08	.01	.02	.31
Item 47	.44	.16	.22	.08	.08	.14	.16	.22
Item 50	.59	.10	.13	.15	.25	.18	.01	.39
Factor 2: (8 items) Style of Problem Solving								
Item 3	.06	.56	.19	.15	.18	-.11	.02	.33
Item 10	.23	.37	.31	.14	.25	.11	.26	.25
Item 14	.20	.41	.31	.24	.17	.14	.18	.24
Item 17	.05	.70	.07	.11	.28	-.01	.05	.57
Item 19	.20	.46	.25	.20	.04	-.01	.12	.24
Item 26	.24	.47	.23	.13	-.08	-.02	.00	.29
Item 32	.22	.33	.20	.21	.13	-.13	.06	.16
Item 35	.10	.31	.12	.18	.25	.09	.06	.15

Table 1 (continued)

Rotated Factor Structure (Correlations), Communality Estimates, and Eigenvalues for Your Style of Thinking and Learning Scale (SOLAT)

Factor 3: (7 items) Planning and Organization	1	2	3	4	5	6	7	h2
Item 4	-.07	.17	.36	.16	.02	-.04	-.08	.20
Item 5	.18	.16	.36	.17	.06	-.03	-.04	.15
Item 11	.14	.23	.44	.10	.05	.10	.01	.21
Item 22	.25	.25	.37	.20	.15	.27	.16	.24
Item 30	.14	.12	.45	.12	.25	.10	.09	.24
Item 40	.40	.23	.41	.04	.36	.00	.17	.34
Item 48	.28	.07	.53	.25	.21	.44	.00	.47
Factor 4: (5 items) Creativity								
Item 12	.29	.34	.37	.44	.12	.01	.09	.30
Item 15	.10	.19	.12	.64	.10	.18	.18	.46
Item 16	-.06	.16	.33	.61	.05	-.02	.07	.44
Item 21	.30	.17	.22	.20	.15	.27	.16	.37
Item 38	.27	.40	.47	.54	.17	-.20	.04	.48
Factor 5: (5 items) Humor								
Item 6	.13	.22	.12	.28	.43	-.10	-.12	.30
Item 9	.27	.25	.15	.20	.54	.21	.22	.37
Item 37	.02	.07	.18	-.09	.41	.07	-.01	.24
Item 39	.26	.31	.25	.23	.39	.18	.22	.32
Item 42	.12	.28	.29	.22	.30	-.10	.07	.20

Table 1 (continued)

Rotated Factor Structure (Correlations), Communality Estimates, and Eigenvalues for Your Style of Thinking and Learning Scale (SOLAT)

Factor 6: (5 items) Logical vs. Intuitive	1	2	3	4	5	6	7	h2
Item 2	.33	-.11	-.03	-.08	.15	.39	.04	.27
Item 13	.07	.00	-.01	.06	-.00	.43	.09	.19
Item 18	.12	-.09	.15	.14	.10	.33	.25	.19
Item 21	.30	.17	.22	.19	.31	.50	.11	.37
Item 29	.40	.14	.38	.13	.16	.48	-.10	.44
Factor 7: (4 items) Reading Preference								
Item 33	.07	.13	-.01	.08	.07	.08	.68	.47
Item 34	-.01	.12	.05	.23	.26	.18	.39	.26
Item 36	.03	.01	.07	.12	.08	-.01	.54	.31
Item 45	-.08	.00	-.02	.21	-.05	.21	.30	.18
Eigenvalues of the Weighted Correlation Matrix	8.25	3.55	2.79	2.09	1.61	1.54	1.24	
Proportion of Variance	.39	.17	.13	.10	.07	.07	.06	

Table 2

Reference Axis Correlations

	Factor						
	1	2	3	4	5	6	7
Factor 1	1.00						
Factor 2	-.11	1.00					
Factor 3	-.26	-.20	1.00				
Factor 4	.00	-.22	-.23	1.00			
Factor 5	-.23	-.13	-.01	-.00	1.00		
Factor 6	-.14	.16	-.07	-.02	-.04	1.00	
Factor 7	-.02	-.09	.02	-.11	-.07	-.11	1.00

Table 3

Internal Consistency and Test-Retest Reliability Coefficients

	Internal Consistency*		
	Time 1	Time 2	Test-Retest
Factor 1	0.61	0.59	0.77
Factor 2	0.57	0.54	0.71
Factor 3	0.56	0.51	0.65
Factor 4	0.53	0.45	0.70
Factor 5	0.35	0.26	0.62
Factor 6	0.45	0.32	0.68
Factor 7	0.34	0.35	0.75

* Cronbach's Alpha coefficients

Table 4

Means and Standard Deviations for Normal and Brain-Injured Adults on Each Dimension of SOLAT

	N	Mean	SD
Factor 1:			
Normal	(74)	1.19	3.24
Brain-injured	(74)	0.61	3.10
Factor 2:			
Normal	(74)	-2.08	3.41
Brain-injured	(74)	-3.04	2.73
Factor 3:			
Normal	(74)	0.30	2.56
Brain-injured	(74)	-0.89	2.59
Factor 4:			
Normal	(74)	0.28	2.30
Brain-injured	(74)	-0.16	2.30
Factor 5:			
Normal	(74)	-0.30	2.14
Brain-injured	(74)	-0.59	1.98
Factor 6:			
Normal	(74)	0.27	2.32
Brain-injured	(74)	-0.39	1.86
Factor 7:			
Normal	(74)	0.38	2.07
Brain-injured	(74)	-0.27	1.82

Table 5

Means and Standard Deviations for Left-Hemisphere, Right-Hemisphere, or Bilateral Brain-Injured Adults on Dimensions of SOLAT

	Left Hemisphere Injury		Right Hemisphere Injury		Bilateral Brain Injury	
	Mean	SD	Mean	SD	Mean	SD
Factor 1	1.00	3.09	0.41	2.73	0.48	3.46
Factor 2	-3.19	2.48	-2.88	3.14	-3.07	2.64
Factor 3	-0.48	2.06	-0.75	2.79	-1.31	2.79
Factor 4	-0.19	2.44	-0.33	2.14	0.00	2.39
Factor 5	-0.29	1.92	-0.91	2.02	-0.55	2.01
Factor 6	-0.57	1.66	-0.46	1.77	-0.21	2.09
Factor 7	-0.14	1.82	-0.42	1.59	0.38	1.97

Table 6

Correlations Between Localization of Brain-Injury and Total Score on Each Dimension of SOLAT

Factor	Injury
1	-0.07
2	0.05
3	-0.04
4	-0.03
5	-0.13
6	0.02
7	-0.07

All correlations non-significant